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EDITORIAL

Plant Quarantine in India. Man's incessant thirst for travel and exchange of goods has aided the development of the world's communications. Oceans and mountain ranges which originally functioned as natural barriers against long-range travel and transport have ceased to be so, and along with the many benefits, the conquest of nature has brought in its train an evil—the involuntary introduction and spread of pests and diseases. Every civilized country in the world is alive to the dangers of such unwanted introductions. Quarantine ordinances are promulgated in these countries for not only preventing or limiting the introduction of pests and diseases but also to control or eradicate them. The legislation of each country provides for the examination of plants and plant products at sea-ports or other points of entry on its borders, and suitable methods of examination and disinfection are carried out by a plant protection service. As a further aid to such examination, the exporting countries are required to have their exports examined within the country of origin and certified. India has not been far behind other countries in enacting the required legislation. The Destructive Insects and Pests Act 1914 of the Government of India and similar legislations in the major provinces and states are instances in point. Amendments and additions to these are being made from time to time to comprehend new problems arising in a field of ever-increasing complexity. Yet, a cursory perusal of the existing all-India Act reveals that the Government of India have not kept pace with the requirements of modern knowledge on plant pests and diseases. To mention one point, clause 4 of the 1936 notification provides for the fumigation of all imports with hydrocyanic acid. We doubt whether this treatment is suitable for several fungous and virus diseases which India does not want. Taking for granted that cyanide fumigation will kill all insect pests, we doubt whether it should find universal application irrespective of the presence of insects. Researches in several countries have shown that different plant species cannot stand the same dose of cyanide and hence it looks apparent that the employment of a variety of accepted phytosanitary methods is called for. Again, while the examination and certification of Indian exports is a function of the Agricultural services of the country, the control of imports is in different hands. The limitations of an organisation which lacks adequate training and experience in phytopathological methods are obvious. It is not our purpose to formulate the proper organisation of the present system, but we hope that some of the points raised by us will receive the attention of the authorities.

The Present Position of *Pollu* Disease of Pepper in Malabar*

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Introduction. Pepper (*Piper nigrum*, L.) is a commodity in which India has for several years held a predominant place in the world's market. The west coast of India enjoyed a practical monopoly till the beginning of 19th century when there was keen competition from the Malay Archipelago.

It is a crop of great commercial importance to Madras Presidency since Madras has always taken a preponderating share of the trade in India in pepper as seen from the following table :

TABLE I. Distribution of the export trade in pepper among the various provinces in India from 1933-34—1937-38.

	Quantity in cwts.				
	1933-34	1934-35	1935-36	1936-37	1937-38
Madras	50,533	60,681	24,939	23,326	16,148
Bombay	7,766	12,715	910	1,158	683
Bengal	521	656	513	480	620
Sind	89	13	45	6	5
Burma	...	5	8	7	...

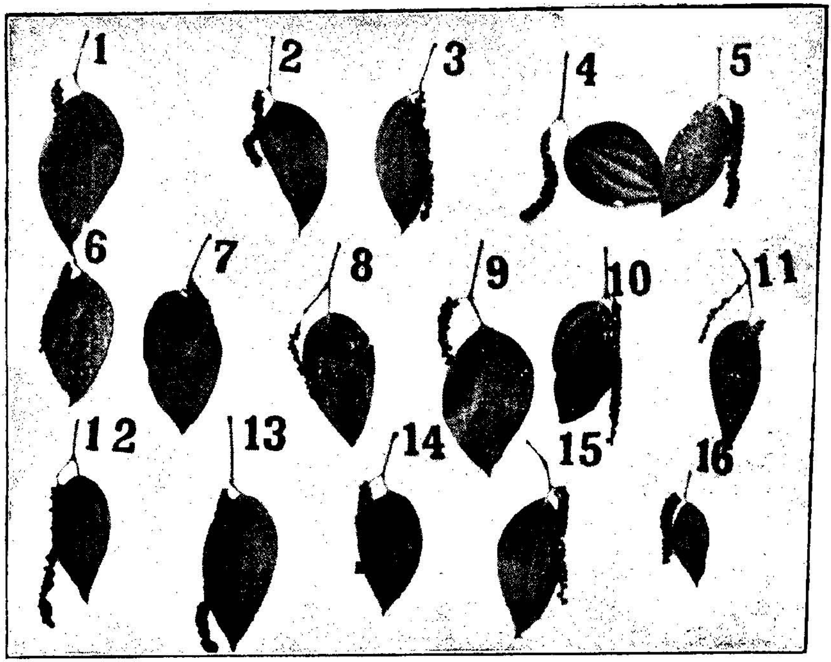
Area. It is extensively cultivated in and below the Western ghats. In Madras the principal producing areas are Malabar, Cochin, Travancore, Mysore, South Kanara and to a small extent Coorg. In Bombay the area under the crop is about 7,500 acres, practically the whole of which is in Kanara. In Bengal it is grown to a very limited extent.

Present depression. It is found that due to (1) world slump in prices and increasing competition from other countries and (2) diminished returns due to pests and diseases, India is losing her hold on the world's markets. The following statement shows the rapid shrinkage in the export of this commodity from India, though the acreage under the crop has either remained stationary or shown a slight increase.

TABLE II. Export of pepper from India and Madras, and the area under pepper in Madras.

Year.	Quantity in cwts.		Value in Rupees.		Area under pepper in Madras.
	India.	Madras.	India.	Madras.	
1933—34	58,909	50,533	18,23,903	14,54,464,	97,011
1934—35	74,070	60,681	24,50,390	18,87,594	95,745
1935—36	26,415	24,939	7,62,852	7,06,574	97,981
1936—37	24,977	23,326	6,08,850	5,64,340	103,924
1937—38	17,455	16,148	3,91,616	3 57,762	104,081

* Paper read at the M. A. S. U. Conference, July 1939.



SOME VARIETIES OF PEPPER

1. *Karuvalli*, bold climber and bearing in alternate years.
2. *Karuvilanchi*, hardy, medium climber, yearly bearing and allied to kalluvalli.
3. *Balamcotta*, bold climber and yearly bearing.
4. *Arikottanadan*, medium climber, yearly bearing and good yielder.
5. *Perukodi*, medium climber and yearly yielder.
6. *Kumbhakodi*, bold climber, yearly bearing and good yielder.
7. *Mundi*, medium climber and yearly bearing.
8. *Thulakodi*, medium climber, yearly bearing and good yielder.
9. *Munda*, medium climber and poor yielder.
10. *Kothanadan*, good climber, yearly bearing and heavy yielder.
11. *Cheriakaniakkadan*, good climber and good yielder.
12. *Valiakaniakkadan*, good climber and good yielder.
13. *Chumala*, bold climber and yearly yielder.
14. *Kalluvalli*, hardy, medium climber and good yielder.
15. *Kuthiravali*, medium climber yearly bearing and good yielder.
16. *Karinthakara*, bold climber, and bearing in alternate years.

Slump in prices and foreign competition. From the following statement, it will be seen that Netherland Indies and British Malaya have increased their exports whereas the exports from India have considerably fallen compared to the average exports during 1927—31. It is evident the production in other countries has increased. This has naturally resulted in a slump in the prices.

TABLE III. Annual export of pepper from some important producing countries.

(Quantity in metric tons) (6)

From	1927—31	1932	1933	1934	1935	1936	1937
Netherland Indies	27,791	35.852	44,330	48,495	58,747	78,399	31,265
British Malaya.	13,374	16,580	16,211	20,437	22,673	10,939	10,885
Java.	7,935	6,327	5,852	4,039	5,011	5,814	1,953
India.	6,735	2,902	3,045	3,343	2 846	722	1,215
Indo-China.	3,953	3,233	3,679	4,002	3,434	3,901	3,791
Sarawak.	1,430	4,295	3,314	4 765	1,766	2,053	2,209
Others.	19,856	29,525	38.478	44.456	53,736	72.585	29,312

Pests and diseases. Among the diseases of pepper *pollu* is the most important. The Malayalam word pollu means a hollow thing. As applied to pepper it means hollow and light berries. In a wider sense the word is more often employed to denote the loss occasioned by the presence in varying quantities of the improperly developed or damaged berries of low commercial value in the harvested crop.

Loss due to pollu. The loss caused to pepper varies from year to year. In some years it is said to be as high as 50 per cent. of the marketable produce.

History of investigations. In 1918 the Government Entomologist made the first attempt at a scientific investigation. In a report (1) the authors discuss the several factors which contribute to the production of *pollu*. From 1923 onwards a combined investigation was made by the Government Entomologist and the Government Mycologist. Interim publications were made from time to time. (2), (3), (4) & (5).

Causes of pollu. There are three causes of *pollu*, viz., (a) physiological, causes producing spike shedding, (b) insect attack--flea beetle and gall-fly and (c) fungus attack (*Colletotrichum* sp.)

(a) *Spike Shedding.* Of the three factors, spike shedding is the most important. This is characterised by shedding of apparently healthy spikes during the period of maturity. The berries collected from shed spikes being immature become very light and partially hollow on drying, the degree of lightness depending on the stage of maturity at which shedding occurs. Microscopic and cultural studies of shed spikes at different periods and from different vines failed to show evidence of fungus, insect or bacterial attack of the stalks of the large majority of spikes. The following table shows the relative importance of the loss caused by spike fall, fungus and insect attack at the Agricultural Research Station, Taliparamba in 1932.

TABLE IV. Relative importance of spike-fall, fungus and insect attack.

Variety of vine	Percentage of spike shedding	Percentage of berries lost by	
		fungus attack	insect attack.
Balamcotta*	46·3	5 6	9·2
Kalluvalli*	37·9	6·1	13·7

* Average for 21 vines.

(*b*) *Insect pollu.* There are two insects which are responsible for the damage caused to berries. One is the flea beetle. (*Longitarsus nigripennis*) and the other a gall-fly. Of the two the latter is comparatively insignificant. The flea-beetle bites small shallow circular holes in the rind of the berry and lays eggs therein, after which it covers the eggs with its excreta. The eggs hatch in 5 to 8 days. The grubs burrow into the kernel and destroy the contents. They later enter neighbouring berries which are similarly hollowed out. A grub destroys about 3-4 berries. Some times the grub in biting its way from one berry to the next may eat into the stalk of the spike and in such cases the distal portion of the spike dries up and turns black and the berries beyond this spot turn black and do not ripen, although they remain attached to the spike almost throughout the season showing a pale dark colour, (2).

The loss from insect attack has been found to vary from 6 to 21 per cent. It may be stated in this connection that in some cases insect attacked berries are difficult to distinguish from fungus attacked berries.

(c) *Fungus pollu.* A fungus (*Colletotrichum* sp.) has been found to be responsible for causing shrinkage and drying up of individual berries and to a small extent for attack on the stalk of spikes. The fungus causes circular or irregular grey spots on the leaves. The acervuli of the fungus appear on the upper surface as small black dots arranged more or less in concentric rings. On the stem the attack begins at the tips and descends to a limited extent and in course of time the stem is killed. Young vines and tender runners from old ones die in this manner. In the case of old vines the attack commences from the region of branching and the fungus is found near the nodes of dead branches. The attack on the spikes and berries is more serious and results in loss of crop. Evidently the infection begins with the leaf and stem. Microscopic examination of the tender fallen spikes disclosed the presence of the fungus at the basal region in some. The spikes are generally found attacked at the place where they spring from the stem. The leaf axils from which the spikes come out are favourable places for the accumulation of water drops and fungus spores, washed down from the leaves. The spores that get lodged here germinate and enter into the tender spikes and grow inside. The fungus inside brings about the rotting of the tissue and causes the spikes to fall. Vines in shady and damp plots shed more than those in open places. The berries from the shed spikes when dried become hollow and light and the fructifications of the fungus appear on them in large numbers. The stalks of the spikes

also develop the same fungus. On individual berries the fungus attack is characterised by a dirty brown discoloration of the rind. It begins from the upper portion of the berry and extends downwards. Some attacked berries get cracked. Later on the berries shrink and fructifications of the fungus appear on them. The extent of loss by fungus has been found to vary from 4 to 13 per cent.

Spraying experiments. *The use of different spray mixtures.* During 1923 and 1924 spraying trials with different strengths of Bordeaux mixture, with different adhesives were done during the month of August, when the berries are well formed and these have been found to have controlled fungus and insect *pollu*. Trials with different strengths of the mixture show that the plants are able to stand a 2 per cent. mixture without any deleterious effect, while a weaker ½ per cent. mixture also is equally effective and at the same time economical. The three adhesives viz., resin, casein, and fish-oil-resin soap which were tried with Bordeaux mixture were found satisfactory. Addition of lead arsenate to Bordeaux mixture to check the flea beetle attack was found to be superfluous as Bordeaux mixture by itself acted as a repellent to the insect (3).

Relative merits of May and October sprayings. A second series of spraying experiments was conducted in 1926 to study this aspect. It was found that May spraying did not effectively control *pollu* while the October spraying was beneficial (4).

TABLE V. Statement showing the effect of May and October sprayings against *pollu* at the Agricultural Research Station, Taliparamba in 1926.

Period of spraying.	Percentage of *pollu* (insect and fungus).	Average for each treatment.
May	19·74	20 05
,,	20 35	
May and October	4·22	2 48
,,	0·75	
October	7·27	5 20
,,	3·13	
Control	32 95	23 07
,,	23 95	
,,	14 30	
,,	21·06	

Replications.	Sprayed in May only.	Sprayed in May and October.	Sprayed in October only.	Control (not sprayed).
1	19 74	4 22	7·27	32 95
2	20 35	0·75	3·13	23·95
3	...	...	...	14·30
4	...	...	...	21·06
Total for each treatment.	40 09	4·97	10·40	92·26
Grand total.	147·72			

Analysis of Variance.

Source of variation.	Sum of squares.	Degree of freedom.	Mean variance.
Between group means	816·48	3	272·16
Within groups error	194·12	6	32·35
Total sum of squares	1010·60	9	

F value $= \frac{272 \cdot 16}{32 \cdot 35} = 8 \cdot 41$ d. f. 3 and 6.

F value from Tables P = ·05 = 4·76
P = ·01 = 9·78

Therefore the effects of different treatments are significant.

1. May *plus* October, and October sprayings give definitely better results than May spraying or control.

2. The differences between May *plus* October, and October alone is far from being significant (i.e) a single spraying in October is as good as two sprayings comprising of one in May and again in October.

3. Single spraying in May is not significantly better than control (i.e.) no spraying.

Spraying and mealy bugs. In the course of the spraying experiments recorded above it was observed that while spraying in October checked insect and fungus pollu, the sprayed vines showed a conspicuous attack of mealy bugs during the subsequent dry weather (4). An experiment was laid out in 1926 to study the relationship between spraying and mealy bugs. Two series of vines viz. (a) *Infested with mealy bugs* and (b) *Free from mealy bugs*, were marked out during May, when mealy bugs flourish most. Each series was sub-divided into 4 groups as follows :

1. Sprayed in May alone.
2. Sprayed in May and October.
3. Sprayed in October alone.
4. Control (unsprayed).

With the advent of the hot weather in the following season (February and May) all the vines under experiment were examined for mealy bugs with the following results :

1. Vines sprayed in May were either free from bugs or the attack was mild.
2. Those sprayed in May and October or October alone showed heavy infestation of bugs.
3. Unsprayed vines were also free or had only traces of bugs here and there.

This experiment definitely proved that October spraying encourages the infestation of mealy bugs. This marks a phase in the investigations when October spraying was found advantageous in controlling *pollu* but it encouraged mealy bug infestation.

Further experiments were laid out in 1927 with a view to discover a means of controlling *pollu* without bringing any evil effects in its trail. These consisted of (1) spraying with mixtures other than Resin Bordeaux and (2) spraying with Resin Bordeaux to the spikes and upper surface of leaves only (mealy bugs occur only on the lower surface). Among mixtures other than Resin-Bordeaux, lime sulphur and Burgundy mixtures proved unsatisfactory (5). Bordeaux mixture again proved good as far as *pollu* was concerned. From the view point of mealy bugs, it was found that both sprayed vines and the controls remained unaffected. This showed that mealy bug infestation is not an inevitable corollary to October spraying but it may occur in certain years only.

Varietal variation in pepper. Experiments were resumed in 1931 at the Agricultural Research Station, Taliparamba to study the incidence of spike fall, *pollu* and yield in relation to the two important varieties in cultivation there. The data obtained are tabulated in Table VI. When the above data were analysed it was found that spike fall is heavier in *Balamcotta* than in *Kalluvalli*. But the combined loss from insect and fungus

TABLE VI. Statement showing the percentages of spike fall and pollu and yield of individual vines.

Serial No. of Vines	Plot 17. A. Balamcotta — Percentage of		Yield in tolas	Plot 18. Kalluvalli — Percentage of		Yield in tolas	Plot 61. Balamcotta — Percentage of		Yield in tolas	Quarry plot Kalluvalli — Percentage of		Yield in tolas
	Spike-fall	Pollu		Spike-fall	Pollu		Spike-fall	Pollu		Spike. fall	Pollu	
1	63.1	20.5	78.75	62.9	16.0	84.25	58.5	24.0	69.75	65.5	50.8	9.50
2	65.7	15.3	78.75	55.2	14.2	102.00	43.8	21.0	52.25	72.4	44.2	17.00
3	61.0	18.4	116.50	35.8	16.5	157.75	70.9	25.5	42.75	76.5	40.3	40.25
4	70.0	18.3	59.75	59.8	19.6	88.00	35.3	30.4	140.50	61.6	36.2	19.50
5	48.1	15.5	83.25	43.9	15.6	127.25	42.4	18.6	196.50	62.6	36.8	17.50
6	40.3	15.5	97.25	32.2	15.0	56.50	45.3	21.8	129.00	39.6	26.5	45.00
7	39.4	14.5	128.75	38.6	16.1	92.00	56.0	24.3	56.00	55.9	30.5	51.50
8	45.6	12.6	124.50	20.0	21.1	164.25	64.0	25.0	42.75	67.3	35.7	45.50
9	40.0	12.5	132.50	21.5	17.6	131.00	43.7	21.0	117.50	76.4	31.1	25.00
10	33.1	11.1	151.75	29.5	20.8	186.00	73.9	30.2	42.00	25.5	27.0	111.75
11	36.2	10.3	103.00	30.4	24.2	199.75	47.9	19.7	131.00	51.9	27.0	39.00
12	41.2	16.0	115.50	22.8	19.6	112.00	53.0	21.5	99.50	37.2	26.5	86.00
13	40.1	15.7	101.50	31.0	19.8	97.75	66.7	27.7	52.00	62.9	32.5	21.50
14	55.6	12.7	50.25	35.2	25.0	41.25	65.1	30.2	78.75	54.7	34.2	25.25
15	37.4	12.9	53.00	41.3	21.0	45.50	34.0	20.2	189.50	43.0	31.2	75.00
16	16.0	13.5	91.75	23.2	21.0	115.50	49.9	28.0	72.25	45.6	31.3	64.75
17	35.5	14.3	113.00	32.0	23.5	74.75	33.7	19.4	92.25	80.9	47.2	12.00
18	60.4	19.4	49.50	47.8	22.6	115.00	54.0	18.3	116.00	68.7	42.2	27.75
19	45.2	17.0	89.50	38.4	20.7	101.75	59.3	29.0	46.50	49.7	23.5	61.00
20	37.9	10.6	120.25	52.2	23.8	57.00	55.8	22.2	64.00	50.6	31.9	62.50
21	60.1	14.7	60.25	42.6	27.6	80.50	64.4	31.8	98.50			

pollu is heavier in *Kalluvalli* than in *Balamcotta*. At the same time it was observed that in the same variety of pepper (*Balamcotta*) spikefall and *pollu* were significantly heavier in one of the two experimental plots than in the other.

Results of analyses

Plot.	Variety.	n.	Average.	S. D.	S. E. of mean difference.	Remarks. (Significance P = ·01)
			Spike-fall.			
17 A.	Balamcotta.	21	46·3	13·38	2·8119	Significant.
18	Kalluvalli.	21	37·9	12·37		
Quarry.	Kalluvalli.	20	57·4	14·70	2 9583	Not significant.
61	Balamcotta.	21	53·2	11·95		
17 A.	Balamcotta.	21	46 3	13 38	2·7681	Significant.
61	Balamcotta.	21	53·2	11 95		
Quarry.	Kalluvalli.	20	57·4	14·70	3 0005	Significant.
18	Kalluvalli.	21	37 9	12·37		
			Pollu.			
17 A.	Balamcotta.	21	14 8	2·82	0·7058	Significant.
18	Kalluvalli.	21	20·1	3·61		
Quarry.	Kalluvalli.	20	34 33	7·60	1 3697	Significant.
61	Balamcotta.	21	24 30	4·38		
17 A.	Balamcotta.	21	14·80	2 82	0·8038	Significant.
61	Balamcotta.	21	24 30	4·38		
Quarry.	Kalluvalli.	20	34·33	7 60	1·3140	Signi icant.
18	Kalluvalli.	21	20·10	3·61		
			Yield.			
17 A.	Balamcotta.	21	95·20	29·6	7 6785	Not significant.
18	Kalluvalli.	21	106·18	40·0		
Quarry.	Kalluvalli.	20	42·86	27 3	8·3800	Significant.
61	Balamcotta.	21	91·87	46·2		
17 A.	Balamcotta.	21	95·20	29 6	8·4664	Not significant.
61	Balamcotta.	21	91·87	46·2		
Quarry.	Kalluvalli.	20	42·86	27·3	7·5630	Significant.
18	Kalluvalli.	21	106·18	40·0		

Remarks. (1) *Spike fall:* The variation of the percentage of spike fall from plant to plant within a plot is very high, probably indicating the possibility of getting at a vine with a very low spike fall. However, if we compare the vines of the different plots we find that the mean spike fall in plot 18 *(Kalluvalli)* is significantly less than in the plot 17 A *(Balamcotta)*. This is a varietal difference which could be taken advantage of in breeding a type with low shedding of the spikes. There is however no significant difference between quarry plot *(Kalluvalli)* and plot 61 *(Balamcotta)* with regard to spike fall, probably due to the difference in soil conditions.

(2) *Pollu.* Variation in this case is from 17 to 20 per cent. only. Variation within any plot is not very high. If the mean values are compared we find that *pollu* in plot 17 A *(Balamcotta)* is significantly less than in plot 18 *(Kalluvalli)*. Similarly in plot 61 *(Balamcotta) pollu* is significantly less than in quarry plot *(Kalluvalli)*. Here again there is a varietal difference.

(3) *Yield:* There is no significant difference in yield between the two varieties.

Proposed lines on which the investigation is to be continued. (1) *Study of varietal resistance.* From a perusal of the foregoing paras it is clear that *pollu* is the result of three factors, viz., spike-fall, insect attack and fungus damage. There is variation between the two varieties under trial. The most promising line of attack therefore appears to be the study of varietal resistance to these three factors. While North Malabar has only two important varieties under cultivation, viz., *Kalluvalli* and *Balamcotta*, there exists a rich collection of varieties in other parts of South India. For example, the State Pepper Farm in Koney, Travancore, has 16 distinct varieties of pepper [Vide Plate]. Besides showing a wide range of variation in such characters as period of flowering, duration, periodicity in bearing, yield, climbing habit, spike length, size of berries, packing of berries in individual spikes, &c , these varieties show different degrees of resistance to spike shedding and insect and fungus damage. A comparative study of all the cultivated and wild varieties in South India promises to be helpful in solving the *pollu* problem.

(2) *Hybridisation.* Apart from discovering existing varieties with certain desired qualities, the large number of varieties available both in India and outside may provide valuable material for evolving new varieties by hybridisation. Some wild types growing in South Indian forests show certain desirable qualities like hardness and very long spikes. Being a vegetatively propagated crop, the prospect of obtaining suitable types by simple hybridisation appears promising.

(3) *Study of agronomic factors.* Besides varietal variation, our studies have also shown that in the same variety grown in different fields there was a significant variation in spike shedding as well as in insect and fungus damage. This observation suggests the necessity for agronomic studies such as (a) study of the root system in relation to soil texture (b) manurial requirements (c) influence of shade, (d) conservation of soil moisture and (e) adverse effects of soil erosion.

(4) *Further trials with insecticides and fungicides.* Studies in the past have indicated the possibilities of controlling insect and fungus damage by the use of fungicides. But the development of mealy bugs on sprayed vines in certain years proved to be a handicap in pursuing this method of control. With a larger range of insecticides and fungicides available to-day, it may be possible to get over this difficulty. It is therefore necessary to study this aspect afresh with a view to discover suitable sprays, right strengths, proper periods for treatments, etc., and to work out their economics.

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Plantain in Madras Province and its Market.*

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[A brief survey of the plantain crop in the Province of Madras and a method to market it in an orderly manner which would remunerate the grower and build up a major provincial trade.]

In India, Plantains (bananas) are found in every petty shop on the road side, hanging in bunches; looking green today and turning yellow on the morrow, soon transferred into a cluster of golden fruits. They are beautiful to look at and delicious to taste.

A story for its latin name. There is a hypothesis prevalent among many, ridiculous though, that the forbidden fruit in the garden of Eden was Plantain. The fine form and the rich yellow colour of the fruit greatly helped Satan to success in his attempt at tempting Eve. Hence the specific Latin name *paradisiaca*. The botanical name is *Musa paradisiaca*.

Food Values. In his fine work, 'Food and the Principles of Dietetics' Dr. Robert Hutchison describes a good food – "That only is to be adjudged a good food which contains an ample proportion of nutritive constituents, which is easily digested and absorbed and which can be obtained at a reasonable cost." Plantain is just that 'good food'.

A good food according to Mr. Eustace Miles must be as free as possible from stimulants and moreover, a good food for purposes of modern life, when everything tends towards over acidity and clogging must have certain cleansing properties. Plantain as a food contains all the above requirements.

Composition of Plantains. In an analysis of *Pachai Vazhai*, a common variety grown in South India, it has been noted that the fruit contains 2·14% of proteid, 21·8% sugar, 1% Fat, 1% mineral matter and the rest water. (Analytical Data).

*Paper read at the M. A. S. U. Conference, July 1939.

Composition percentages of fresh fruits. (Prof. Plimmer.)

Fresh fruit.	Waste.	Water.	A. S. H.	Fibre.	Protein.	Fat.	Carbo-hydrate (sugar.)	Calories per lb.	Vitamin.
Plantain.	43·3	40·2	0·5	1·2	0·6	0·1	14·1	278	A B B_1 B_2 C D
Apple.	9·2	77·5	0·3	0·7	0·3	0·2	9·8	196	*to* * * ** *low
Grapes.	5·1	80·3	0·5	0·6	0·6	0·1	13·2	261	* * * * * to ** Juice Extract.
Orange.	15·1	65·1	0·4	0·3	0·6	0·1	6·6	137	* * V. low.
Pears.	12·7	74·0	0·3	1·4	0·3	0·1	7·9	144	* *
Pineapple.	32·7	58·4	0·3	0·3	0·3	·0	7·5	145	** ** Medical Research Councils Special Report. Series No. 167.

* = Contains vitamin.
** = Good source.
*** = Rich source.
B = Complex water-soluble.
B_1 = Separately estimated.
B_2 = Separately estimated.
Blank = Not tested.

Nutritive value of Banana and other foods compared (Fawcet.)

	Banana.	Banana Flour.	Wheat Flour	Oat meal.	Potatoes.
Moisture.	75·50	11·10	14·10	8·9	78·3
Protein.	1·26	3·55	11·4	15·5	2·2
Fat.	·50	·83	1·0	10·1	·1
Carbo-hydrate.	21·70	81·80	75·0	54·8	18·4
Mineral Matters.	·76	2·23	1·7	4·0	1·0

Its use in medicine. Plantain has many medicinal properties. Its claim in the medical field as an aperient has long been established.

Sir H. M. Stanley in 'Darkest Africa' (ii p. 239) writes:—**For infants, persons of delicate digestion, dyspeptics and those suffering from temporary derangements of the stomach, banana flour properly prepared would be of universal demand.'**

Civil Surgeon R. A. Parker M. D. in 'Dictionary of the Economic Products of India,' states:—**A combination of ripe banana, tamarind and common salt is most efficacious in dysentry both for the acute and chronic forms of the disease and seldom failed to effect a cure.'**

According to Civil Surgeon J. H. Thoronton B. A., M. D., 'The tender fruit is used for patients suffering from haemoptysis and diabetes.'

Cultivation in India. In India plantain or banana is cultivated in the north, on the banks of the rivers in Bengal. In Bombay it is grown as a garden crop. In Assam and Burma it is grown to augment the food supply of the people and so cultivation is common all over. In the Southern Provinces it is grown in all the districts without exception. It is

produced on all types of holdings from the small kitchen garden for home consumption to vast stretches on the commercial scale. Hence it is difficult to gather accurate data on plantain acreage, the extent of cultivation and yield.

In the season and crops report of the Madras Province for 37-38, it is stated that the acreage devoted for fruits, vegetables and root crops for that year was 691, 470 acres. The normal is 679, 470 acres. Of this area 24% which is 138, 480 acres was completely devoted to cultivation of plantains.

TABLE I. Plantain acreage in Madras and average yield in tons.

District.	Acreage normal.	Yield in tons. (normal)
Vizagapatnam,	4,400	27,500
East Godavari,	5,250	32.812
West Godavari,	5,290	33,063
Kistna,	600	3,750
Guntur,	1,130	7,062
Kurnool,	400	2,500
Bellary,	840	5,250
Anantapur,	40	250
Cuddapah,	330	2 062
Nellore,	540	3 375
Chingelpet,	2,420	15,125
South Arcot,	1,720	10,750
Chittoor,	950	5,937
North Arcot,	990	6,187
Salem,	5,750	35,937
Coimbatore,	5,510	34,437
Trichinopoly,	9,350	58,437
Tanjore,	11,500	71,875
Madura,	16,500	103,125
Ramnad,	3,400	21,250
Tinnevelley,	7,640	47,750
Malabar,	53 400	333,750
South Canara,	3,490	21,812
The Nilgiris,	700	4,375

Plantain production in Madras Province. On a modest average of 700 plants per acre, it may be said to yield 6¼ tons weight of plantain fruits with an average weight of 20lbs per bunch. Based on the Commerce Director's report the yield for 37-38 should be 865, 500 tons. It is difficult to assess the value of production as there is no standard price for a perishable commodity. Plantain is sold at the rate per hundred fruits ranging from Rs. 3 the highest paid for the famous *Sengadali* variety to 4 as. paid for *Puvan.* Usually the prices centre between 6 to 12 annas per hundred. In the absence of proper data we may roughly fix it at 3½ crores of Rupees calculated at 6 as. per hundred.

Varieties cultivated in the province. There are about twelve commercially different varieties and some are popular throughout the Province. Jacob who has conducted a survey on Plantain cultivation in Madras reports 65 different varieties and some of them only useful for culinary purposes.

TABLE II. Commercially known varieties, where they are grown and their prices per hundred. Variable.

Name of Plantain.	Price per 100.	Where it is grown.
Ayranka Poovan,	12 annas,	Stray throughout the Southern portion of the Province.
Anakomban.	8 annas,	Coimbatore and Nilgiris.
Chakrakeli,	Re. 1/8 as,	Circars and in East and West Godavari.
Kathali,	Re. 1/8 as,	Chiefly in Malabar.
Kali,	6 annas,	Malabar.
Kapur,	12 annas,	South Canara.
Karuvazhai,	6 annas,	Sirumalai Hills.
Kunnan,	6 annas,	Malabar.
Myndoli,	12 annas,	Cochin State.
Manoranjitham,	8 annas,	Trichy Dt. and Kulitalai.
Attu Naendran,	2 annas,	Malabar.
Nana Naendran,	12 annas,	"
Pachai Vazhai,	10 annas,	Trichy, Gudiyattam, Chittoor, Coonoor and Kolakambai.
Puvan,	14 annas,	Southern parts of Province.
Puvan (Ney)	8 annas,	Malabar.
Pachai Nadan,	8 annas,	Southern parts of Province.
Payan,	12 annas,	Tanjore District.
Pae Kunnan,	8 annas,	Shevoroy Hills.
Rastali,	Re. 1,	All over the province and chiefly in Tanuku, Salem, Trichy, Malabar, Nilgiris and stray in Malabar.
Sengadali or Sevvalai,	Rs. 3,	Chinglepet, Simhachalam, Vizagapatam Nilgiris and Malabar.
Suganthi,	10 annas,	Bellary, Siruguppa, Adoni and Kampli.
Sirumalai,	10 annas,	Sirumalai Hills.
Then Kunnan,	6 annas,	Malabar.
Thattila Kunnan,	...	"
Vannan,	...	"

Markets and Marketing. Late in 1908, the U. S. Counsel at Calcutta wrote in his report 'It is claimed that vessels properly fitted up can reach the Liverpool market from Calcutta in 25 days and that several kinds of fruits, *especially the plantain*, can be laid down in Liverpool market to compete the West Indian Banana, which now monopolizes the English market. The East Indian banana, both yellow and red, grows abundantly throughout Southern Provinces and the supply could be made practically unlimited. The fruit is in India and needs a market and if enough money is raised to back the enterprise, it is believed that India can get her share of the banana trade of Europe and hold it.'' That was written in 1908. Since then many changes have taken place. The new Cochin Harbour is a boon to South Indian export trade. The distance has been cut. Faster steamers with cold storage fittings are available at comparatively low rates.

Conditions being so favourable and the prospects for trade development promising, one naturally expects a brisk internal trade if not foreign, but a survey of the present local trade reveals very depressing

conditions. In the Madras Province the only trade worth mentioning is in *Pachai Vazhai* exported from Trichinopoly. Dindigul sends *Sirumalai* and *Virupakshi* varieties chiefly to Madras and a few other districts.

No data for this little inland trade is available. The broker or commission agent plays an all important role. He buys from cultivators in rural areas and consigns them to fruit depots from where it is sold to the retail shops and to street hawkers.

No proper attention is being paid for the preservation of the fruit during storage and transit, with the result the cultivator is paid low; the broker taking the risk on consigning them to towns on the forward price basis. The retail dealers and vendors in town are not happy over a good margin of profit in the sales of such perishable products. The consumer often pays a high price due to this inefficient marketing.

In some large towns the two or three wholesalers visit the garden in the up country from time to time to purchase then and there or enter into an agreement with the producers in advance of the season, to buy up the produce at certain fixed rates.

The transport media they use for consigning the fruits to their town depots are usually bullock carts padded with hay that travel over night 20 miles and reach the town at dawn.

In Malabar, a brisk trade in fritters (fried plantain chips) is carried on but it is confined more to the local market. I have seen fritters usually selling out as soon as they are put in view on the stalls which is generally towards evening. The trade would increase if more hygenic methods are adopted and the fritters not exposed to the road-side dust. It is said that a little volume of this commodity is exported to places like Madras, Hyderabad and Bombay. Commission agency plays a major part in this little export trade also.

It can be safely pointed out that with the expansion of banana trade banana fritters will play an important role in the export trade.

The best varieties of the fruit are available, the supply of any variety could be made unlimited and it can be sold at competing prices in the western market. There is a good potential market. What next ?

Markets & marketing. Competitive selling of one product in a market tends to weaken price levels in the long run. It usually means unnecessary expenses in canvassing, distribution and over-heads. Whereas coordination of sales efforts tends to better net realisations even if market prices remain unchanged. Efficient marketing is not what volume of sales are effected but what profit is attainable in the net turnover at the same time keeping the consumers' price at a reasonable level.

Plantain is a perishable article which has to be consumed within a limited period. It is not possible to sell perishable articles by skilful adjustments to local and seasonal demands like storing and releasing supplies at just the place and time when and where competitors have left a gap.

Naturally the position of plantain sellers would be stronger only when their number is small.

In that little trade that is carried on at present the middle man or commission agent who acts the role of marketer to the cultivator is alleged to play an indifferent role without caring much either for the producer or the consumer. The knowledge of his indifferent attitude and the money that he makes has a very heinous effect on the morale of the cultivator.

The consumer will take to more plantains only when the grade is of a superior quality. The cultivator will take to quality growing only when he is certain of being paid for his labours. He will take sufficient interest only when his interests are protected.

Cooperative marketing—a possibility. In Plantain trade Co-operative marketing is the only system that incorporates these basic principles of orderly marketing of perishable goods.

The advantages of a cooperative marketing association are manifold. It would be possible then to gather together the products of many small growers and to market them at distant hubs (concentrated markets). The grading, packing and despatch could be better supervised by the organization's trade mark with a reliability for the standard of quality. Uniform grades in plantain are much more satisfactory to the consuming public than miscellaneous lots. The producer gets the full benefits of the advantages derived from large scale operations and favourable trade connections. He is protected from being exploited by unscrupulous petty dealers and middle-men who play the role at present. He is sure of an outlet for his crop. Underselling is avoided and sales are always at remunerative figures. Besides, market news are available through the organization. The organization would be able to place the fruit to much better advantage than could individual sellers or growers. The small grower and the large estate owner both would get equal beneficial results of expert salesmanship of the organization.

A cooperative organization would require the guidance of experts for its formation, development and maintenance. The government must be willing to back and promote the enterprise by subsidy in the initial stages.

This could develop in course of time to the formation of a central provincial Marketing Association through affiliating various district units. The District units will collect the fruits and meet the local demand. The central unit will occupy itself in controlling the distribution both inland and foreign. Publicity campaigns would be planned and executed by them and further they can work in co-operation with the Central Agricultural Research Department, for bettering the quality of growing etc.

Co-operative marketing organization. Once the decision is made on the main principles, immediate attention should be diverted to grouping the areas and locating depots for collection purposes.

Pooling the produce: The first stage in co-operative marketing is pool, ing the produce and grading them on the quality basis. For efficient collection work the provincial area must be divided into units based on the yield,

kind and quality of the fruits. This is simplified as mostly particular varieties are grown at particular places. In forming the centres, main attention should be paid to transport facilities and geographic factors. This is all the more necessary as rapidity in action is the key note in fruit marketing, from the time the fruit bunch is cut from the stalk in an up country plantation until it reaches the consumer's table. The collection depot of every sub-unit area must be located, easily accessible to all the cultivators in that sub-unit area. Harvesting should be carried out on a distributed time and season by all the cultivators in the area as far as possible on particular days of the week to simplify collection work. Regular visits of the collecting agent to these areas would give him knowledge of the probable successive harvests. The district unit is able to inform the central provincial organization about the quantity available in the market during the following week. Control of distribution is made easier and is carried out efficiently.

Marketing the fruits collected; Once all the produce of the unit area has arrived at the warehouses of the District centres, the next stage is *Dealer Marketing,* and consigning to provincials for forwardal to the places where needed and thus avoiding flooding at any one centre.

Marketing naturally divides itself into two main functions; *Dealer marketing* and *Consumer marketing.*

In Dealer marketing the problems encountered are 1. transport 2. freight rates 3. storage facilities and 4. the selection of intelligent and capable sellers.

The District unit's central depot must be located preferably close to the city market hub which would enable a close watch over the market trends and consumer reaction. At the same time the location of the depot must be easily accessible to all up country plantations However, with a little careful planning the collection area may be made to be in close proximity of the dealer marketing area thus forming a homogeneous market. Usually the best transport facilities available are easy to obtain at these hubs. Retail shop owners from the suburbs pay periodical visits to the citys' hubs and contact could be thus maintained with them. The cutting down of freight rates are effected by carefully choosing the transport media.

Consumer Marketing has only a consumer advertising problem to deal with. Advertising media in this country are few and they cover a vast area. Hence consumer areas cover wider areas and the whole province may be divided into three or four such consumer areas based on the language spoken, religious customs prevalent and geographic factors.

Transport. Transport is an important factor in the marketing of perishable commodities and hence careful attention should be paid to it. The media used for conveying the fruit from its stalk from an up country plantation to the consumers' table are said to be; human labour, bullock cart, motor lorries and some times rail.

The first stage is from the stalk to the collection depot. The Linlithgow Commission in their report p. 373 have observed, " The provision of

excellent main roads adequate in all respects for every form of transport is of little benefit to the cultivator if his access to them is hampered by the condition of the road which connects his village with them. What matters to him is the state of the road between his village and the main road and the market."

Conditions since then have not been bettered and so long as they are not improved the best transport media would be human labour. Jamaica has found donkeys more economical and efficient and if the South Indian would take to it, it should be the choice.

From the collection depot to the District main depot two transport media are available. Bullock carts and crude oil run lorries. Bullock carts travel over night 20 miles. Some collection depots might use bullock carts padded with hay if that is economical or lorries whichever is advantageous. The large planter should as far as possible deliver his produce straight at the District depot in his own lorries.

In long distance transport such as from the District depot to the Provincial or to another District main depot there are only two media available ; motor trucks and rail.

Both in motor transport and especially in rail transport as has been observed wastage might occur due to ripening process taking place on the way. Such ripening is very uneven (i. e.) they arrive at the destination in three conditions ; semi-ripe, over-ripe and boiled state. It is possible to prevent this by careful attention being paid when cutting the stalk at the proper time at the plantation.

The Bombay department of Agriculture which have conducted successful experiments on the keeping quality of the bananas recommend in their leaflet No. 6 of 1933 ; the immediate application of paraffin wax to the cut surface on the stalk. It would increase the keeping quality of the plantain fruits on the bunch. They further claim that this process keeps the fruit fresh for a longer period and that fruits do not drop from the stalk. Fruits get a good yellowish attractive color when ripe and no dark spots are formed. Rotting of fruits is appreciably checked. A pound of paraffin wax that costs four annas is sufficient to treat 100 bunches.

Rail transport. The problem encountered in rail transport are more numerous than in motor transport. Freight rates are heavy and properly ventilated vans are not available. The fruit usually arrives in boiled and semi-boiled state. The fruit damaged in transfer is an unavoidable evil owing to two different gauges in the railway. And there is one more unpleasant fact to be pointed out namely pilfering of fruits, during transit. In the words of Messrs. Howard and Howard, in improvements in packing and transport of fruits In India,—(*Vide* Agricultural Journal of India, Vol 8, 1913.) ' The question of numerous thefts in transit, on the railways, remain to be mentioned. These cases are exceedingly numerous and they amount to nothing short of scandal.

In these days of good roads — fast automobiles at low running costs, crude oil run motor lorries could be found to a much better advantage.

The co-operative organization. Regarding the entire organization it would comprise a central board, a provincial marketing board and various distrit units affiliated to the central board.

The distribution of work and personnel would be ;

Central Plantain Aid Board.
(Government of India aided-elected Council of growers and traders).

Provincial Marketing Organization.

Provincial unit.	District Unit.
Produce distribution. Dealer marketing. Transport. Allied export trade. Warehousing.	Collection and grading. Consumer marketing. Local transport. Fritters, figs and plantain. Flour manufacturing.
2	2
Market news bulletins. Publicity campaigns. Control of price. Research and Extension work.	Development, local sales campaign, growers club, campaign for better quality growing and demonstrations etc.
3	3
Co-operative Industry Aid Loan Bank.	Local Loan Bank.

The distribution department of the central organization would be controlling the allied industries of the Dt. units such as fritter products banana flour and figs. The central organization that controls the distribution would be able to have first hand knowledge of local markets and also the foreign ones, thus best fitted to control the distribution.

The Agricultural Research department in co-operation with the central organization could introduce the latest crop improvements in plantain cultivation for improvements of quality and quantity.

Credit schemes. The formation of a co-operative bank run by the central organization would be more in the interests of the small growers. The system of controlled credit would be the proper method. The present lines on which the Cuddalore Co-operative Warehouse is operated might be introduced. In this case the bank's work is still minimised in that marketing is done by the organization and the District Unit is closely supervising the cultivators' activities and the bank is an allied branch of the organization.

This is only a very brief survey. The organization should be planned out by experts of each particular branch. Another note could be added that such an organization cannot come into existence by itself. What is wanted is enterprise and co-operation from Government and leading planters.

Self-Help in Economic Farming.

By K. UNNIKRISHNA MENON,

Deputy Director of Agriculture.

Conservation of waste Materials. In the human system food is digested and the nourishment circulates in the form of blood. From certain glands products like bile are secreted and again used in the system for digesting food. If the removal of such products is delayed or stopped the blood gets impure and the system becomes unhealthy. If they are not properly stored and made available to get mixed with food in the digestive organs the digestion gets impaired and the system suffers from malnutrition. The position is somewhat similar with regard to a household and farm. If the waste materials of a household, cattle shed or farm-yard are not properly removed and stored in a regular manner, the place becomes insanitary. If they are not properly conserved and utilised as manure, the fertility of the soil suffers and results in poor crop yield. This upsets the economic position of the farmer and can be well compared to the anaemic condition of a bilious patient.

Making farming profitable. Many an educated man turns round and says that farming as such is not paying. Depending purely upon cultivation of crops makes some farmers indebted. The remedy for this state of affairs is also suggested by those people when they say that the farmer must take to some other ways of enriching himself. His debts must be cleared and he must be provided with funds for financing his cultivation better. Others suggest that the farmer must take to cottage industries and the profits from them should make up the deficit in farming. This is like the transfusion of blood to the anaemic patient unmindful of the fact that we have first to remove the fundamental cause of the economic anaemia or poverty from which the ordinary farmer is suffering. This transfusion of blood cannot go on for long. Therefore what is necessary before anything else is done, is to make farming profitable by all means and then let the farmer take to side lines of farming. One who advises the farmer to do it the other way about asks him to put the cart before the horse. If one part of the business does not pay, it is wise to ask him to stop that business and to take to something that pays. But this is not usually done. On the other hand, we are telling the poor farmer too many things that he should really get confused. Is it right to try all these various experiments on the poor and ignorant farmer before we take pains to go into the question as to why he is finding a deficit in farming? Any agricultural officer will be able to convince a ryot that he should conserve all his waste products as manure and use them to enrich his lands before he can make farming anything like a paying business. He agrees to this idea and determines to adopt the best ways of conserving manure. The moment the Demonstrator or the Demonstration maistry disappears, from the scene the farmer often goes back to his old system of wasting

manurial matter by his unthrifty ways of removal and conservation. He often pays for chemical manures and uses them while wasting his own resources of manurial wealth which he could have conserved and used as manure much cheaper, had he devoted a part of his attention to this subject in his every day life. Therefore in every rural uplift scheme the first item of work must consist in making the farmer devote his best attention to manure conservation so that all his manure wealth is available for use in his fields. Added to this he may grow green manure crops providing a very cheap method of increasing the supply of leaf manure to any field. Until these two items of work are adopted, other ways of improving the economic position of a farmer will all be hasty steps liable to break down. They may even divert his attention from the fundamental items of work he should do to improve himself. To my mind it looks that there is nothing more valuable in the possession of a farmer, than his own house-hold manure. It is more valuable to him than the land itself, because most lands if not adequately manured cannot give a profitable return. This fact will be clearly seen when an application of Re. 1/- in the form of manure will bring in an additional yield worth at least Rs. 2/- from a five months crop of paddy, granted that other conditions are the same in both the manured and unmanured fields. By adopting proper methods in collecting and preserving manure, a farmer can increase his manure supply at least five-fold and increase the crop yield considerably. Comparing Malabar and South Kanara, two districts under almost similar conditions of rainfall snd soil, one can easily see that the South Kanara ryot gets a comparatively higher yeild of paddy from a given area. South Kanara with its population of about 5 people per acre of paddy land under cultivation is able to export rice to Malabar which has less than 4 people depending on an acre of paddy land. Malabar has not only no surplus but has to import rice for her requirements. This is mainly due to the better system of manure conservation adopted (loose box system) in South Kanara and the leaf manure application given to every paddy land. The Malabar ryot allows his cattle manure to be wasted in various ways and neglects leaf manure application although he may have facilities for procuring the leaves needed and using them to the paddy lands.

To continue the analogy I employed earlier, the anaemic patient is also suffering from chronic consumption. By this I mean the large amount of undetected loss of manure and fertile soil that occurs from a given area by erosion. Erosion is rampant in all the dry lands. It has been found that even from the fairly flat black cotton soils under low rainfall the erosion amounts to 115 tons of the best soil a year. It is considerably more in more rainy and uneven areas. The water and the fine fertile soil that it carries away from the land are both of immense value to the farmer who knows little that he is losing such a large part of his wealth. In all possible cases effective methods must be adopted to stop or reduce the loss of rain water. This will automatically save for the soil what is carried away by rain water. The experience in our dry farming station has proved beyond doubt that the

evil effects of drought can be considerably prevented by putting small contour bunds in dry fields. The drought conditions in Coimbatore District this year have indicated that even in a 'dry' year better plants could be seen at the lower levels of fields near the bunds where rain water laden with silt could have stood and soaked in for some time.

Apart from all these, how the anaemic and consumptive patient has contracted a cancer of avoidable debts could be seen if we go deeper into the system of his working. He has to purchase work animals. The animals that he purchases surely deteriorate in value every year in such a way that a capital of Rs. 150 spent on a pair normally shrinks to about Rs. 60 in 3 years' time. Can he afford to allow such a heavy depreciation on his already slender resources ? He cannot. This condition gets aggravated when a work animal dies from epidemics or from natural causes. He has to purchase an animal again and suffer the depreciation which follows. This is the cause of the accumulated debt from which the farmer patient is unable to recover. How to remedy this debt-cancer eating into his resources is the question. In answer to this comes the first stage when side lines of farming should be adopted. Every farmer must take to cow-keeping as a side line of his farming. A few milch cows should be available to supply him milk both for sale and for consumption. It pays him to grow fodder crops and feed both the cows and calves properly. This will assure him of a daily cash income by sale of milk and milk products. If the calves are properly fed they will form the future animals both for work and milk purposes. If the system is regularly adopted he increases his manure supply and can always be the owner of a few additional coppers every day enabling him to hold up his grains for sale at optimum prices.

Leaving this question aside for a moment we shall try to go into another question—going back to land. It is found that the credit usually available to an average tenant cultivator is low and he has to pay higher interest or profits to secure loans for his cultivation expenses. With this idea in view and for the very welfare of his own property a land owner has to take a living interest in his lands and cultivate at least a portion of them adopting the up-to-date improved methods. The investigations made by the Imperial Council of Agricultural Research recently have shown that in the garden lands of Coimbatore district a cultivating land owner can secure from Rs. 15 to Rs. 20 more per acre, than a non-cultivating land owner.

In the Vizagapatam district the owner cultivator gets a nett profit of Rs. 97 against Rs. 52 per acre of a non-cultivating owner from sugarcane and Rs. 22—8—0 and Rs. 20 respectively from paddy. In the Bellary district the figure shows an increase of Rs 5—8—0 per acre of dry land and 74—11—0 in case of wet land per acre in favour of the cultivating land-owner.

Therefore with all the defects that are inherent in the present methods of farming there is a certain amount of profit in farming, the more so when

the land-owner cultivates his own lands. This is certainly an information that should attract the educated young man who has land but goes to the town taking up an employment on a paltry monthly income leaving the land to be looked after by tenants and relatives who swallow the lion's share of the income. If people owning lands choose to spend their full energy on land adopting all the suitable improvements advocated by the Department, their income from lands can be considerably improved so as to enable them to secure better living wages in their own villages. For this purpose the educated man has to change his urban outlook and think in terms of his own relations in the village. If such a thing happens he can try to adopt side lines of farming such as fruit cultivation and preservation, bee-keeping, hand-spinning etc., to provide leisure time earnings for himself and his family.

Finally I would say that such people as have a liberal education and a broad rural outlook can serve as leaders in a village and adopt improved methods in preparing their produce for the market. Marketing as a separate question is now receiving special attention at the hands of Government in the direction of better pooling, cheaper transport, improvement of quality, grading etc. for the betterment of the farmer. For organising marketing properly in the villages the presence of educated farmers is absolutely necessary. It will be their duty to help the Marketing Section of this Department and the Co-operative Department by educating the villagers as to what best they must do to secure higher prices for their hard-earned produce. By the adoption of improvements in marketing methods at every stage we can secure better prices for the produce. Added to this a large part of the profits now shared by the middlemen can be diverted to the pockets of the producer himself making farming much more paying than at present. Thus agriculture can contribute its quota to the prosperity of the country.

A Note on *Vettiver* Cultivation.

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Introduction. Vettiver (*Coleus sp.*) as the name indicates is a crop grown for its roots which possess a pleasant fragrance. In South India, ladies wear bits of the roots in the hair. The roots are also used for making garlands to decorate temple images.

Seasons and Soil. This crop is cultivated in all seasons and stays in the field from 3 to 4 months. The plants being delicate, require constant care, attention, and labour; and naturally the area which could be handled by an individual cultivator has to be limited to a few cents. Plantings have also to be so regulated as to yield a continuous supply to the market.

Since the roots are slender and grow to a yard's length and more, a deep sandy soil is very necessary for easy penetration of roots. The plants are bushy reaching a height of only $1\frac{1}{2}$ foot. The crop needs copious supply of water for good growth.

Cultivation. The crop is propagated vegetatively from stem cuttings which are planted on elevated beds of sandy soil 6" to 12" deep. Elongated beds of 2' width and convenient lengths of, say, 12 yards are made with interspaces of the same length and width. A cent of land will hold 3 beds of this size. The beds are dug well to the required depth and to each bed 2 or 3 baskets of farmyard manure and 4 lb. of groundnut cake are applied and well incorporated. The edges of the beds are raised all round to a width of 6" leaving one foot wide space in the middle for planting. Cuttings are taken from mature plants and planted in groups of five holes each. Each hole receives three cuttings. The five holes in a group are so spaced that there are four holes at the corners of a one foot square and the fifth one is at the centre of this square. The next group of holes is made 9" from the previous one and this process is continued until the whole length of the bed is planted. In a bed of 12 yards length, there would be thus 20 groups of holes for planting the cuttings.

The planted setts are pot watered daily until they strike root. Subsequently the beds are irrigated twice a week or oftener depending on the weather conditions. The spaces between the beds could be utilised as water channel from which water is splashed on to the beds with scoops. Where facilities for flow irrigation are lacking, hand watering can be pursued throughout. About 32 irrigations are necessary to bring the crop to maturity. The after cultivation consists of two hoeings at intervals of about 20 days.

Harvest. When the crop is ready for harvest the soil from the sides of the plants is carefully dug out and the sand from the exposed roots is washed out by a continuous stream of water. The plants with the roots

are released from the soil, and the green tops are cut off. The fibrous roots are ready for sale immediately.

The roots from six clumps fetch a rupee in the market, and there are 60 clumps in a cent of land which should therefore bring in a return of ten rupees. The expenses of cultivation amount to about five rupees leaving a profit of five rupees provided there is an easy market.

The details of cultivation are given below.

Cultivation charges for one cent of land.

		Rs.	as.
Digging the land and forming beds	...	0	4
Manure—½ cart load of farm yard manure	...	0	2
Groundnut cake—½ maund	...	0	6
Cost of one thousand setts	...	1	8
Planting the setts	...	0	4
Hoeings—two, at intervals of twenty days	...	0	4
Cost of 32 irrigations	...	1	0
Harvesting charges	...	0	12
Miscellaneous charges such as cost of pot etc.	...	0	8
		5	0
Price of produce from one cent of land	...	10	0
Net gain from one cent of land	...	5	0

SELECTED ARTICLE

The Influence of Manure on Potato.

(Translated by N. Krishnaswamy)

(Die Einfluz von Wachstumsbedingungen und Anbaumaznahmen auf Knollen und Starkeertrag sowie den Speisewert der Kartoffeln. Dr. Elsner-TrierenbergY *Die Ernahrung der Pflanze.* Heft 8, XXXV, 1939. p 238-241).

The potato plays an important role in the political and industrial economy, of a country. The yield and quality vary with climatic conditions. Still it is possible to neutralize these factors, by the employment of proper cultivation methods. That being so, the author feels that the knowledge of the many sided exchange relations between the individual growth factors on one hand and the yield and quality of the tubers on the other, is very important.

The 'Utilitarian value' depends upon the purpose to which the potato shall be put, whether it is used as animal feed, for industrial purposes (such as manufacture of alcohol, strach, flake etc.) or as human food. So far as commercial and industrial purposes are concerned, the primary object to be realised is a high total yield and the highest starch return per unit area. In the culinary potato the importance of the starch content more or less recedes to the back ground. On the other hand the properties of flavour, quality, colour, of the skin and pulp, consistency, cooking-qualities, the position of the eyes, the shape of the tuber etc. are particularly important.

Now and then protests are made by potato-consumers that through the use of the artificial manures a depreciation of the quality sets in, in particular the "typical and spicy aroma of the potato" becomes "soapy and stale". Careful experimentation on the flavour (on about 37 experiments) have however, brought no confirmatory evidence. They showed that even unusually high manuring with artificials gave only results which lay within the usual margin of error. No significant conclusions could be made out in this direction. Hence it is concluded that in potatoes meant purely for culinary purposes complete manuring is necessary, since it would in no way prejudice the flavour, while a reduction in manuring would only result in malformed smaller tubers and a lowering of the yield.

To supplement the above experiments certain manurial trials were conducted in which the manuring was rather one sided and from the stand point of accepted practice, completely incorrect. A permanent manurial experiment with the rotation rye—potato was made. In this potassium defeciency was found to have a very bad effect. The plots with 'No manure' and N + P gave only 20—25% the normal yield, because the plants showed the effects of the K defeciency, e.g. brown colouring of the leaves soon after sprouting and eventually became rotten and died. Flavour tests showed that the yields of plots without any K were worse than those with deficient N or P. The boiled potato was un-wholesome and greyish yellow in colour which by longer staying, became dirty yellow, whereas those from the standard plots retained their attractive colouration. It was also found that a heavy potash manuring brings about an even, natural light yellow colour on white tubers, which as a rule is preferred by the users.

The taste tests conducted on potatoes from lots which were strongly overmanured gave no significant indication of injury in reference to either P or K manuring singly. A little though practically insignificant, lowering of the flavour was found in plots manured with all the three principal ingredients together and also in one plot with N only.

From these experiments it follows that the belief that artificial manures spoil the flavour of culinary potatoes is groundless and that manuring, on the other hand, influences the taste less than the strain (variety) and soil constitution.

Besides climate and manure, the two last mentioned factors *viz.* variety and soil constitution, and various cultivation methods are of first rate importance in influencing the crop of potato. Particularly valuable is the practical application of the above mentioned possibilities to allow up to a certain point to make the yield independent of the climatic conditions which have an injurious effect on the quality. The correlation of some of these factors were worked out.

Within the various potato varieties a great amount of fluctuation was found with regard to yield and starch-content. In conformity with popular belief, leaf quantity in the first place,—though varietal to a certain extent,—and

long duration showed that the late potatoes gave the highest yields. On an average a fluctuation of about 8 percent was found in the starch content of the varieties. In 1926 the greatest differences were noted e. g. between *Fruhrose* (poorest in starch content-11·4 per cent.) and *Parnassia* (richest in starch - 21·3 per cent.) a difference of 9·9 %. But in the same season with in the same sort very significant differences in starch content (and of course yield also) up to 8·4 % were obtained. This was largely consequent upon external influences like faulty manuring, drought or early frost etc, which reduced the vegetative period, or to hailstorm, late blight, insect pests etc, injurious to the foliage which reduced the assimilation products. These disturbing influences were more apparent in the early than in the late variety. In general, it was noted that under ideal, favourable growth conditions the potato gives in the first place a high return of tubers while when any one of them fails owing to some cause or other, the starch content as such is increased.

No significant and regular correlation between the starch content from climatic conditions could be determined. There occurred only one exception, viz. the conditions of 'budding' and 'apical growth' of the tubers which are controlled by climatic conditions normally and towards the end of the rain period. The opinions on this point is rather contradictory. In general in the medium-early to medium-late varieties the newly formed tubers are richer in starch than the older ones. In the late varieties the condition is reserved, according to the degree of ripeness of the newly formed tubers. After all, the yield of the tuber and starch must be regarded, at the utmost, as dependent on the condition of the ripening and the degree of ripeness.

These points were made clearer through experiments. They showed that (in the variety *Parnassia*) with the rise in the yield of tubers the starch return also increased e. g. between flowering time and the ripening time it nearly doubled itself. This became clearer in the total yield of starch from 1·71 doppelzentner* per hectare † (at flowering time) to 74·28 dz/ha (at ripening time) while the tubers yield for the same periods was 17·5 and 358·9 dz/ha and the starch content from 9·7% to 20·7%. It is very remarkable that the grade of ripeness is mainly dependent to a great extent on the length of the vegetative period. The yield of plants decreases both in very early and very late harvests. The shortening of the vegetative period through premature death of the aerial parts of the plant more or less through poverty of the nourishing materials, leads to a lessening of harvest yield, starch yield and starch content. From some of the permanent manurial experiments conducted, it was found that in plots which had no Potash, but had enough quantities of N and P, the potato plants died much earlier than those manured with K + P + N. Potash defeciency leads also to shortening of the vegetative period and naturally to markedly low yield. The manures given were ammonium sulphate (100 Kg./ha. N.) superphosphate (70 Kg./ha. P_2O_5) and 40% K-manure salt (180 Kg./ha. K_2O).

1. † One hectare = 2. 47 acres ; 2. * one doppelzentner = 1 quintal or 2 cwts.

A marked decrease of tubers yield and starch also were caused by certain diseases which caused detrioration e. g. leaf-roll (virus) disease. In the same way shading (as by mist or cloud) affects the crop causing reduction in the amount of sunlight required for starch formation.

Whereas the size of the seed-material, and the method of its preservation during winter, (stored whether in cellar or pits, with or without preservatives) gave no definite results, the yield differences, the choice of the strain and manuring showed greater influence. The average of 3 years results out of 32 manurial experiments including the stableyard manure also showed K-manure increased yield in all directions.

When artificial manures containing chlorides are applied there is a slight reduction in yield. In such conditions also, the N and P remaining constant increasing dozes of K (60, 120, 180, Kg/ha. K_2O as 40 % K-manure salt) showed that at least in light soils there is not much reduction in the yield. It followed also that fairly heavy doses of chlorides did not reduce the yield.

The results of a series of experiments on the influence of the same quantity of K manure at various periods of the life history of the potato plant (before sowing, after germination, before flowering) are given in the following table. These showed that a 200 Kg/ha. K_2O (at 40-50 % potash manure salt and first as K-sulphate and K-magnesia) increased not only the tuber yield but also the starch content.

Manuring per ha.	Average of 1928 to 1935. Yield of tubers dz/ha.	% Starch.	Yield of starch dz/ha.
Unmanured	186	18,3	34,1
$N+P_2O_5$	250	17,8	44,5
$N+P_2O_5+200$ Kg. K_2O of 40%K - salt			
1. before sowing	278	16,9	47,0
2. after germination	277	16,7	46,2
3. before flowering	267	17,0	45,4
$N+P_2O_5+200$ Kg. K_2O of 50% K - salt			
1. before sowing	285	17,0	48,4
2. after germination	287	16,8	48,2
3. before flowering	281	17,1	48,0
$N+P_2O_5+200$ Kg. K_2O K - sulphate			
1. before sowing	291	17,7	51,5
2. after germination	296	17,9	53,0
3. before flowering	279	17 9	50,0
$N+P_2O_5+200$ Kg.K_2O K - magnesia			
1. before sowing	287	17,8	51,1
2. after germination	285	17,8	50,7
3. before flowering	271	18,0	48,7

In this experiment all the plots were manured in all the years with a 80 Kg/ha of N. in the form of am. sulphate and 100 Kg./ha P_2O_5 as superphosphate. They showed very convincingly that 50 % of K-manure salt is still better than 40% and the addition of K-magnesia influences advantageously the starch content and the total yield of tubers and starch.

ABSTRACTS

Honey as a stimulant to the Rooting of Cuttings. During the last few years, a great deal of work has been carried on to show the effect of various synthetic substances "Phyto-hormones" on the rooting of cuttings. Experiments conducted at the Central Experimental Farm, Ottawa, Canada show that honey has a definitely stimulating effect on the rooting of cuttings of Chrysanthemum. It is said that this may be due to any one of the many substances in the honey, or to a combination of two or more of these. A 25 per cent. solution of honey, in water for 6 hours was used. (*Canadian Journal of Research*).

pH for Healthy growth in Citrus. As a result of the studies, recently made, it is concluded that citrus can grow under alkaline conditions. When the nitrogen is added to the solution in the form of calcium nitrate the active growth of citrus roots in such cases will reduce the degree of alkalinity. In certain types of alkaline soils, citrus root can change the pH about them so as to secure adequate nutrition; in other types of alkaline soils, the assistance of acid supplements may be needed. Depending on the stage of the absorption process, the roots may also increase the alkalinity The change in the solution brought about by the roots may not be of the pH best suited to healthy growth. Root-rot is often attributed to lack of aeration from one cause or another. In these experiments root rotting occured when the pH remained near 8·1, although an abundant air supply was run continuously through the culture solution. Vigour was quickly restored to such of the rooting roots as remained alive by the addition of sufficient acid to the culture. (A. R. C. H. *Imperial Bureau of Hort and Plantation Crop* Vol. VIII, No. 1 abstract in *Tropical Agriculture* Vol. XVI, No. 8, 1939).

EXTRACTS

Treatment of Citrus and Windbreak Trees affected with Iron Chlorosis. What appears to be a problem of increasing importance for many citrus growers in southern California is the so-called "lime induced" or iron chlorosis. The manifestation of this trouble—assumed to be a nutritional deficiency of iron—is the light yellow or white color of the leaves, the veins retaining the normal green color for a longer time. A general decline of the tree follows, and there is dying back of the branches, culminating in the death of the tree after several years.

While this is not a new disease in agriculture, nor is it new in a few limited areas of central and southern California; it is only in the last three or four years that it has advanced to any extent into some of the citrus orchards located in good, deep, valley soils Dr. J. P. Bennett of the college of agriculture, University of California, after studying the disease in Santa Clara county, where it threatened the deciduous fruit industries, developed a standard treatment for trees based upon the injection of soluble iron salts into the trees. It has long been a recognized fact that plantings made on the highly calcareous soils of many of the upper bench lands would develop the symptoms of lime induced chlorosis; and that such soils should not be used. But our problem of dealing with the chlorosis in older orchards which have been planted on good soils and which have been healthy and vigorous for 20 to 30 years is another matter. From the standpoint of maintaining a permanent citrus culture in southern California, the advance of this disease offers a subject for scientific investigation to find

out what is happening in our soils that is throwing the nutrition of the trees "out of balance". For the moment it appears that we must deal with the disease in an emergency to preserve the health and productivity of the trees until the solution to the real problem is found for removing the cause. Dr. David Appleman, plant physiologist in the staff of the college of Agriculture at U. C. L A., having been closely associated with Dr. Bennett in the past, has, since September 1936, aided in a study of the problem as it has been developing in citrus, avocados, bluegum windbreak trees and other plants. He has helped with test plot treatments which have been based largely upon the methods outlined by Dr. Bennett. Many iron compounds have been compared, also studies have been made in the relative responses to treatments made in different seasons of the year.

Injections of ferric citrate—a soluble iron salt—into the trunks or branches of the trees have produced in some cases rather startling responses in the correction of the disease. The method consists of boring holes with a twist auger, using a $\frac{3}{8}$" bit, halfway into the trunk or branch ; then filling the holes with the dry iron salt. The material is packed in by means of a special "gun". Sufficient space is left in the hole to insert a cork stopper or a dry wood dowel cut to fit snugly in the hole. Some asphaltum base wound paint is used to finish the job. The number of holes required depends upon the size of the tree For the eucalyptus tree, the number recommended is one hole for each two inches of diameter. The holes are spaced about equal distance apart around the trunk, going in a spiral beginning about six or eight inches above the ground. While findings are not complete it is indicated that it may be more effective to treat the old citrus tree by individual main branches rather than the trunk. Trunk injections on young citrus, bluegums, sycamores, and pines have been very effective. Avocados and older citrus have manifested responses in varying degrees to the treatment, but thus far the results are not as encouraging as with the other species named.

For best results of this treatment, the time or season of the year is important. It should be done just prior to or at the start of a flush of growth. Treatments made between March and August have been more effective and have shown less tendency to bark injury around the injections than those made in the period from September on through the fall and winter.

The length of time in which the trees will remain healthy after such treatment has not yet been determined. Some of the trials are now in the third year and are holding satisfactorily. The treatments in deciduous orchards which were established by Dr. Bennett have held for three to six years, and longer.

In treatment of young trees and shallow rooted plants, where the injection method cannot be used, it is necessary to treat the soil. Based upon experiments on young lemon trees and eucalyptus trees three months to one year old, we have maintained a satisfactory growth by applying iron sulphate to the soil. This was done by dissolving one-half pound of ferrous sulphate (copperas) in a bucket of water and pouring the solution into the soil basin around the tree. This may be repeated through the year as frequently as necessary, watching the foliage for return of the symptom ; in some instances the copperas applications were made about every six to eight weeks during the first year. After the trees had grown to a size where the injection method was possible, the ferric citrate treatment was made. *The California Citrograph*, 24: (1939) 89.

A Blight Resistant Chestnut. Several years ago the Bureau of Plant introduction of the U. S. Department of Agriculture brought in shipments of the Chinese

chestnut *Castania mollissima* in an effort to find a variety that would be resistant to the chestnut blight which worked such havoc in the chestnut area of the United States that practically every American chestnut has been destroyed. Crosses of one or more of these chestnuts were sent to the Bartlett Tree Research Laboratories, and among them was one which has grown for 20 years and has fruited for several years. The nut, too, is similar to that of the American chestnut in size, quality, and sweetness. Mr. Bartlett early recognized its merits and has distributed more than a thousand one-year-old seedlings to commercial nut growers in different sections of the United States. Because of the service rendered by Mr. Bartlett in co-operating with federal agencies in the distribution of this promising cross, the chestnut has been named by government workers the Bartlett chestnut.

In some instances, our native chestnuts have sprouted for a few years, and some have even fruited but then succumbed to the blight so that it does not appear likely that a disease-resistant native chestnut will grow again in the areas originally affected by the blight. (*Scientific American*, Vol. 161, No. 2).

Vitamin Alphabet going out of Style. The vitamin alphabet, that is, designation of the various vitamins by letter, is going out of style. For example, if you want to be really up-to-day, you must learn to say ascorbic acid instead of vitamin C when you are referring to the substance in orange juice (or other citrus fruits, tomatoes, and other vegetables) which prevents and cures scurvy.

This may be discouraging, especially if you pride yourself on having really learned the vitamin alphabet, or most of it But the scientists who have most to say about vitamins—the nutritionists and biochemists—are trying their best to get the vitamins out of the alphabet. They make the point that the letters did very well for names in the early days of vitamin discoveries when only a few were known and not much was known about them Now, however, since there are about as many vitamins as letters of the alphabet, with half-a-dozen going under the name of B, it is confusing and even leads to inaccuracy to call these essential food factors by letter.

Some of the vitamins have been identified chemically and even made synthetically. They have regular names, just as other chemicals have. Vitamin C is ascorbic acid. Thiamin is the beriberi preventing and curing substance that once went under the name of vitamin B or B_1 Nicotinic acid, the stuff that is curing pellagra, is the chemical that was variously called vitamin B_2, vitamin G and the P—P or pellagra preventing factor. Riboflavin is another diet-essential that was once labelled vitamin B or vitamin G. Recent discoveries have shown that it is necessary for the health of both man and other animals.

The anti-sterility vitamin, formerly called E, is now known as alpha tocopherol. Vitamins A and D may keep their letter names for sometime, because there is not so much confusion about them as about the B vitamins. Until the chemical composition of other vitamins is discovered, however, scientists favor calling them by descriptive names, not by letters. (*Scientific American*, Vol. 161, No. 2)

Seedless Watermelons. Seedless watermelons have been produced by treating the unpollinated flowers with napthalene acetic acid. The melons were all seedless but varied in shape Some, however, were normal in shape and size. The texture of these fruits was firm and solid. No difference in flavor could be detected from normally pollinated fruits. The work on these fruits is being done by Cheong-yin Wong at Michigan State College. (*Scientific American*, Vol. 161 No. 2.)

Citrus canker eradication. More than 25,000,000 abandoned and escaped citrus trees in Texas and Louisiana have been destroyed in the past four years in the

citrus canker eradication work of the U. S. Bureau of Entomology and Plant Quarantine. These trees were largely abandoned nursery plantings and seedlings spread from such plantings. Citrus canker is believed to be eradicated from the principal commercial citrus producing sections. (*The Californian Citrograph*. Vol. 24, No 10, pp. 360).

Correspondence.

To The Editor,

Madras Agricultural Journal.

Sir,

Agricultural Propaganda.

Suggestions have been made in the pages of this Journal for improving the methods in agricultural propaganda. Among these, the gramaphone and the cinema carry a special appeal to popular fancy. If the object is merely to gather a large audience, the gramaphone or even some kind of vocal music will be enough. The cinema, of course, has become popular even in remote villages, and is the best means of securing a huge gathering. But for the purposes of successful agricultural propaganda this alone is not enough. It is but just the beginning. The chief object in any novel method of agricultural propaganda is to make the cultivating public understand, appreciate, and criticise the several items of agricultural improvement for which propaganda is sought.

It has been suggested for example to put topics of agricultural interest in story form or film versions in story form. Neither is found to have lasting effect. It is possible, say to put "clean picking in Cotton" in a song form devoid of dry unromantic science in a tune favourite with the public say "*Suno Suno Ban Ki Prane*" and commit it to the care of a popular music star: say, Kokilagana Subbalakshmi. But the interest of the people will linger longer in the melody than in the matter. It is only a cultural few that can appreciate meaning in a song. The majority of the cultivating class know no music more appealing than the music of the plough.

Again in regard to the cinema, stories of agricultural interest are apt to lose their effect on the audience unless they are of a telling and appealing nature. This is not possible without the aid of exaggerated romance and adventure. Agricultural topics can have least claim to these effects. They are prosaic and matter of fact. Also efforts at keeping up the element of interest while handling a scientific subject will have the inevitable tendency of side tracking from the essential fact to the non-essential romance, with the result the man who sees the picture thinks more of the fun in the story and ignores the useful part of it by laughing away for a while.

Nevertheless, the cinema abounds with possibilities. The animated cartoon version suggested editorially in a recent issue of the journal is a very valuable method. But it is bound to be costly, not to speak of want of talents like Walter Disney. It is suggested here that agricultural films should be in the form of travelogues. Films like Frank Bucks "Bring em back alive" have no less interest than films of enacted stories.

It should be possible for agricultural experts to sit together and devise a comprehensive agricultural scheme which can be put in the form of a travelogue news reel. To keep up interest the film can with a degree of discrimination be interluded with folk songs, comic village scenes and dances in appropriate sequence.

A Union Member.

Crop and Trade Reports.

Statistics—Crop—Sugarcane—1939—Second report The average of the areas under sugarcane in the Madras Province during the five years ending 1937—38 has represented 2·8 per cent of the total area under sugarcane in India.

The area planted with sugarcane up to the 25th September 1939, is estimated at 122, 740 acres. When compared with the area of 90 800 acres estimated for the corresponding period of the previous year, it reveals an increase of 35·2 per cent.

The increase in area is general and is attributed to favourable prices prevailing for jaggery. The increase is marked in Vizagapatam (plus 4,800 acres), East Godavari (plus 1,500 acres), Bellary (plus 4,800 acres), Anantapur (plus 1,000 acres), South Arcot (plus 4,800 acres) and the Central districts (plus 13,300 acres).

The condition of the crop is generally satisfactory. The seasonal factor for the Province as a whole works out to 98 per cent of the normal and on this basis, the total yield for the Province is estimated at 343,120 tons of jaggery as against 256,050 tons for the corresponding period of last year.

The wholesale price of jaggery per imperial maund of 82 2/7 (equivalent to 3,200 tolas) as reported from important markets on 9th October 1939 was Rs. 9—14—0 in Adoni, Rs. 8—15—0 in Vizagapatam, Rs. 8—4—0 in Rajamundry and Chittoor, Rs. 7—14—0 in Vellore, Rs. 7—7—0 in Cuddalore and Salem, Rs. 7—6—0 in Cocanada, Rs 6—10—0 in Vizagapatam Rs. 6—9—0 in Erode, Rs. 6—7—0 in Trichinopoly Rs. 6—6—0 in Bellary, Rs. 6—4—0 in Mangalore and Rs. 4—14—0 in Coimbatore. When compared with the prices published in the last report, i. e, those which prevailed on 4th September 1939, these prices reveal a rise of approximately 18 per cent. in Vizagapatam, 12 per cent. in Chittoor, 10 per cent. in Cuddalore, 6 per cent. in Rajahmundry and Bellary, 4 per cent. in Trichinopoly, 3 per cent in Salem and 2 per cent. in Vellore and Erode and a fall of approximately 26 per cent. in Mangalore and 1 per cent in Coimbatore, the prices remaining stationary in Vizianagaram, Cocanada and Adoni.

Statistics—Paddy—1939-40—First forecast report. The average of the areas under paddy in the Madras Province durings the five years ending 1937-38 has represented 13·4 per cent of the total area under paddy in India.

The area sown with paddy up to the 25th September 1939 is estimated at 5,469,000 acres. When compared with the area of 6,377,000 acres estimated for the corresponding period of last year, it reveals a decrease of 14·2 per cent.

The estimated area is the same as that of last year in the Nilgiris, a slight increase in area is revealed in the districts of East Godavari, Kistna, Guntur, Kurnool, Bellary and South Kanara but this is more than counterbalanced by a decrease in area in the other districts. The decrease is marked in the *Carnatic* (−429,000 acres), North Arcot (−115,000 acres) and Tanjore (−90,000 acres) and is reported to be due mainly to failure of rains at sowing time in the South-West monsoon period.

The first crop of paddy is being harvested in parts of the districts of East Godavari, Chittoor, Trichinopoly, Tanjore, Malabar and South Kanara. The yield is expected to be normal in East Godavari and on the West coast and below normal in the other districts. The condition of the standing crop is generally fair.

The wholesale price of paddy, second sort, per imperial maund of 82 6/7 lb. as reported from important markets on 9th October 1939 was Rs. 3—0—0 in Madura, Rs. 2—14—0 in Vellore, Rs. 2—13—0 in Trichinopoly, Rs. 2—12—0 in Chittoor,

Rs. 2—11—0 in Virudhunagar, Rs. 2—10—0 in Vizianagaram, Rs. 2—9—0 in Rajahmundry, Ellore, and Bezwada, Rs. 2—8—0 in Cocanada, Masulipatam, Guntur, Kumbakonam and Tinnevelly, Rs. 2—5—0 in Hindupur, Conjeevaram and Negapatam and Rs. 2—0—0 in Anantapur. When compared with the prices published in the last report, i. e., those which prevailed on 6th February 1939, the prices reveal a rise of about 26 per cent. in Madura, 25 per cent. in Kumbakonam, 23 per cent. in Negapatam, 22 per cent. in Trichinopoly, 21 per cent. in Vellore, 18 per cent. in Cocanada, 14 per cent. in Ellore and Bezwada. 12 per cent. in Hindupur and Conjeeveram 11 per cent in Vizianagaram, Rajahmundry, Masulipatam and Guntur and 5 per cent. in Virudhunagar and a fall of about 5 per cent. in Tinnevelly, the prices remaining stationary in Anantapur and Chittoor.

Statistics—Crop—Gingelly—1939-40—Second Report. The average of the areas under gingelly in the Madras Province, during the five years ending 1937-38 has represented 15·6 per cent of the total area under gingelly in India.

The area sown with gingelly up to the 25th September 1939 is estimated at 525,400 acres. When compared with the area of 517,500 acres estimated for the corresponding period of last year, it reveals an increase of 1·5 per cent.

The estimated area is the same as that of last year in Tanjore and South Kanara; an increase in area is revealed in Anantapur, Chingleput, South Arcot, North Arcot, Salem, Coimbatore, Ramnad and Malabar and it is partly counterbalanced by a decrease in area in other districts The variations are marked in Vizagapatam (−20,000 acres), East Godavari (−23,000 acres), West Godavari (−19,000 acres), Chingleput (plus 17,500 acres), North Arcot (plus 25,000 acres), Salem (plus 43,000 acres), Coimbatore (plus 10,000 acres) and Trichinopoly (−19,000 acres).

The early crop of gingelly has been harvested in parts. The yield was generally below normal due to unfavourable season except in South Arcot and Trichinopoly where it was reported to be normal.

The wholesale price of gingelly per imperial maund of 82⅐ lb. (equivalent to 3,200 tolas) as reported from important markets on 9th October 1939 was Rs. 6-10-0 in Vizagapatam, Rs. 6—8—0 in Vizianagaram and Cocanada, Rs. 6—6—0 in Trichinopoly and Tinnevelly, Rs. 5—15—0 in Rajahmundry and Tuticorin, Rs. 5-11—0 in Ellore, Rs. 5—7—0 in Salem and Rs. 5—6—0 in Cuddalore. When compared with the prices published in the last report i. e, those which prevailed on 7th August 1939, these prices reveal a rise of approximately 21 per cent. in Salem, 17 per cent. in Trichinopoly. 13 per cent. in Vizagapatam 8 per cent. in Vizianagaram and 2 per cent. in Tinnevelly and a fall of 7 per cent. in Rajahmundry, 5 per cent. in Cuddalore, 4 per cent. in Ellore and 1 per cent. in Tuticrin, the price remaining stationary in Cocanada.

Statistics—Crop—Groundnut—1939—Third forecast report. The average of the areas under groundnut in the Madras Province during the five years ending 1937-38 has represented 50·1 per cent. of the total area under groundnut in India.

The area sown with groundnut up to 25th September 1939 is estimated at 2,863,200 acres. When compared with the area of 3,198,400 acres estimated for the corresponding period of the previous year, it reveals a decrease of 10·5 per cent.

A slight increase in area is reported from the districts of Vizagapatam, East Godavari, Bellary, Anantapur and Malabar but this is more than counterbalanced by a decrease in area in the other districts The decrease is marked in South Arcot (−120,000 acres), the Central districts (−167,000 acres) and Madura (−51,000 acres) and is reported to be due mainly to want of rain sat sowing time.

The summer crop throughout has been harvested. The yields were generally below the normal except in Anantapur and Cuddapah where they were estimated to be normal. The yield of the early crop is reported to be below the normal in Salem and Coimbatore.

The condition of the main crop is reported to be generally satisfactory outside North Arcot and Salem where the crop is said to have been affected to some extent by hairy caterpillar.

The wholesale price of groundnut (shelled) per Imperial maund of $82\frac{2}{7}$ lb. (equivalent to 3,200 tolas) as reported from important markets on 9th October 1939 was Rs. 5 in Cuddalore, Rs. 4–14–0 in Vizagapatam, Rs 4—12–0 in Vizianagaram, Rs. 4—8--0 in Guntur, Rs 4—3--0 in Anantapur, Rs. 4—2—0 in Hindupur, Rs. 4—1--0 in Adoni, Rs. 4 in Nandyal, Rs. 3—15—0 in Coimbatore, Rs. 3-14-0 in Bellary and Cuddapah. When compared with the prices published in the last report i. e., those which prevailed on 7th August 1939, these prices reveal a rise of approximately 12 per cent. in Anantapur, 8 per cent. in Adoni, 7 per cent. in Vizagapatam. 6 per cent. in Vizianagaram, Guntur and Hindupur and a fall of approximately 7 per cent. in Cuddapah, the prices remaining stationary in Nandyal, Bellary and Cuddalore. *(From the Director of Industries and Commerce.)*

Cotton Raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 13th October 1939 amounted to 434,832 bales of 400 lb. lint as against an estimate of 388,900 bales of the total crop of 1938—39. The receipts in the corresponding period of the previous year were 458,443 bales. 348,186 bales mainly of pressed cotton were received at spinning mills and 172,210 bales were exported by sea while 123,963 bales were imported by sea mainly from Karachi and Bombay. *(From the Director of Agriculture.)*

Agricultural Jottings.

(From the Director of Agriculture, Madras.)

TIRUVOTTIYUR MILCH CATTLE MARKET

Market Report No. 12.

Madras, Friday the 22nd September 1939

Ongoles have gone down both in quantity and quality while good type country buffaloes have arrived in larger numbers. The market is steady though Delhi buffaloes are in poor demand. Prices remain steady.

The following gives the stock movements and prices during the week ended 21st September 1939.

	Stock at commencement.	Arrivals.	Sales.	Balance at the end.
Cows-Ongole	176	66	69	173
Buffaloes-country	280	183	211	252
Buffaloes-Delhi	7	8	4	11

Age.	Milk yield.	Prices from	Prices to
Cows-Ongole.		Rs.	Rs.
1st and 2nd calving	2—3 Madras measures	no stock	
	3—4 ,, ,,	100	130
3rd and 4th calving	2—3 ,, ,,	60	80
	3—4 ,, ,,	80	100

Buffaloes-country.				
1st and 2nd calving	2—3	,, ,,	60	90
	3—4	,, ,,	90	120
3rd and 4th calving	2—3	,, ,,	55	75
	3—4	,, ,,	75	100
Others.				
Buffaloes-Delhi			130	200
Cows-Cross-Bred			150	200

Market Report No. 13.

Madras, Friday the 29th September 1939.

Arrivals of cows and buffaloes were low and the stock of Ongole cows available at the market continues to be poor. Though there has been a fall in the prices of both cows and buffaloes, buyers are not active. The Delhi buffaloes are not being imported.

The following gives the stock movements and prices during the week ended 21st, 29th September 1939.

	Stock at commencement.	Arrivals.	Sales.	Balance at the end.
Cows-Ongole	173	68	107	134
Buffaloes-country	252	124	146	230
Buffaloes-Delhi	11		2	9

Age.	Milk yield.	Prices From	To
Cows-Ongole.		Rs.	Rs.
1st and 2nd calving	2—3 Madras measures	70	90
	3—4 ,, ,,	no stock	
3rd and 4th calving	2—3 ,, ,,	55	70
	3—4 ,, ,,	70	90
Buffaloes-country.			
1st and 2nd calving	2—3 ,, ,,	60	90
	3—4 ,, ,,	90	110
3rd and 4th calving	2—3 ,, ,,	55	70
	3—4 ,, ,,	70	90
Others.			
Buffaloes-Delhi		120	200
Cows-Cross-bred		150	200

Market Report No. 14.

Madras, Friday the 6th October 1939.

Arrivals of both cows and buffaloes continue to be low. The prices are steady at the low level reached last week. The market is very dull.

The following gives the stock movements and prices during the week ended 6th October 1939.

	Stock at commencement.	Arrivals.	Sales.	Balance at the end.
Cows-Ongole	134	83	77	140
Buffaloes-country	230	110	120	220
Buffaloes-Delhi	9			9

Age.	Milk yield.	Prices From	To
Cows-Ongole.		Rs.	Rs.
1st and 2nd calving	2—3 Madras measures	70	90
	3—4 ,, ,,	90	120
3rd and 4th calving	2—3 ,, ,,	55	70
	3—4 ,, ,,	70	100
Buffaloes-country.			
1st and 2nd calving	2—3 ,, ,,	60	90
	3—4 ,, ,,	90	120
3rd and 4th calving	2—3 ,, ,,	55	70
	3—4 ,, ,,	70	90
Others.			
Buffaloes-Delhi		120	200
Cows-Cross-bred		150	200

1 Madras measure = 4 lbs.

College News & Notes.

Students' Corner—Students' Club—Games Tour. The members of the Students' Club went on a games tour to the West Coast and participated in cricket and hockey matches at Calicut, Tellicherry, Cannanore and Mangalore. The party left Coimbatore on the 15th of September 1939 and played the first series of matches at Calicut on 16—9—39. The College team met the Kerala Club at a cricket match, in which our team entering first scored a huge total 217 for 2 wickets and declared. The home team batting next compiled a poor total of 57 for 9 wickets. Playing for the college team, C. Ramaswami was unbeaten with 133 which included 12 fours and 6 sixers while H. Shiva Rao retired with a well earned 40. The college team was assisted by K. Dinker Rao our ex-captain who bowled with unerring accuracy and captured 6 wickets for 21 runs.

In a hockey match played on the same day against the Kerala Club our team was defeated by 7 goals to 5.

On the 17th, the party left for Tellicherry and was engaged in a cricket fixture against the local Sports Club. Entering first, our players compiled a total of 126 (C. N. Babu 30, C. Ramaswami 38, Moidu 5 for 28, Haridoss 3 for 27) as against a total of 60 gathered by the home team, Dinker Rao being again the most successful bowler taking 5 wickets for 23. Our team thus won the match.

The Hockey match played against the Town Sports Club on the 18th ended in a draw—the scores being 2 all. As the staff members had to return to their headquarters at this stage, further fixtures were played by teams drawn up from the students alone.

In the cricket matches played at Cannanore against the combined Cannanore XI on 19—9—39 and against M. C. C. at Mangalore on 21—9—39, our College was defeated.

The hockey match played against Young Mens' Club at Cannanore on 20-9-39 ended in a defeat for us by 5 goals to nil, but our team drew their hockey match against the M. H. C. at Mangalore on 21-9-39 the scores being 2 all.

Local Cricket Matches. On 12-10-39, a cricket match was played between 1st and 2nd year students which ended in a draw. Mohiuddin of the 1st year class was unfortunate in missing his century by 5 runs. Batting first the 1st year scored 219 (Mohiuddin 95, S. V. Srinivasan 19, T. Chellappa 26, and K. Sanjiva Shetty 47 not out). The II year compiled a total of 190 for 6, Satynathan making 59, N. Kamath 43 and K. M. Somanna 73. On 14-10-39 the Agricultural college played the Government College, Coimbatore, at home grounds and won the match. Entering first the home team scored 118 (S. V. Srinivasan 43, Sanker Rao 21; and N. Kamath 16, P. B. Srinivasan 8 for 41.) The Government College were all out for 98 (Natesan 33, Ramanath 20, S. V. Srinivasan 6 for 43). A friendly cricket match was played on 15-10-39 between the Estate eleven and the Agricultural College team. The Estate eleven were all out for 145 (Natesan 27, Venugopal 22, Venkatachalam 43, Kothandaraman 6 for 58). The Agricultural College team compiled a total of 235 for 5 and thus won the match (C. Ramaswami 114, H. Shiva Rao 48 retired and Somanna 42 not out).

The Officers Club—Club Day Cricket. This match was played on 6-10-39. The teams were led by Messrs. C. Ramaswami and K. M. Thomas. Batting first Thomas' team put in a total of 203 (Kodandaraman 28, K. M. Thomas 85 retired, N. L. Dutt 29, C. N. Babu 32). Entering next C. Ramaswami's team scored 109 for 9 when the match was abandoned due to rain. (C. Ramaswami 56, K. Sanjiva Shetty 34) The match ended in a draw.

Visitors. A batch of about 30 students from the Hindu College, Guntur led by Sri. Venkateswara Rao, B. Sc. Ag., Lecturer in Agriculture at the Hindu College visited the Agricultural College and Central Farm on 17-10-39.

Students' Tour. The final year B. Sc., Students were on a tour to places of Agricultural interest from 3-10-39 to 18-10-39. The party was led by Messrs. M. Kanti Raj. and T. Nataraj. They visited Tenkasi, Courtallam, Punalur, Nagercoil, Quilon, Trivandrum, Ernakulam, Cochin and Agricultural Research Station, Pattambi.

Officers' Club Day. The Agricultural College annual club day was celebrated on the 21st and 22nd instants with great eclat. The annual dinner was held on the 21st night at 9 P. M. and the rest of the activities connected with the club day where held on the 22nd amidst a number of amusements and a variety of interesting games and items.

Weather Review—SEPTEMBER 1939.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	6·9	−0·6	22·6
	Calingapatam	4·7	−2·7	18·2
	Vizagapatam	2·8	−3·7	14·5
	Anakapalli*	12·0	+4·3	22·1
	Samalkota*			
	Maruteru*	4·4	−2·7	17·5
	Cocanada	5·0	−0·8	22·5
	Masulipatam	5·2	−1·0	17·0
	Guntur*	4·2	−2·1	15·8
Ceded Dists.	Kurnool	3·9	−2·3	13·2
	Nandyal*	0·0	0·0	0·0
	Hagari*	2·8	−2·9	13·3
	Siruguppa*	4·7	−1·8	16·6
	Bellary	2·7	−2·4	10·2
	Anantapur	7·6	+0·3	19·0
	Rentachintala	3·6	...	14·5
	Cuddapah	10·1	+3·8	18·2
	Anantharajupet*	2·3	−3·1	13·5
Carnatic	Nellore	1·7	−3·1	9·6
	Madras	5·3	+0·3	14·7
	Palur*	6·7	+3·3	23·1
	Tindivanam*	5·2	+1·3	17·7
	Cuddalore	8·4	+2·3	29·2
Central	Vellore	8·1	+0·8	20·1
	Salem	7·1	+0·5	32·7
	Coimbatore	1·1	−0·4	9·1
	Coimbatore A. C. & R. I.*	0·9	−0·9	9·7
	Trichinopoly	2·1	−2·7	20·3

Division	Station	Actual for month	Departure from normal @	Total since January 1st
South	Negapatam	2·2	−1·6	21·5
	Aduthurai*	3·2	+0·4	23·5
	Pamban	0·3	−0·9	8·9
	Madura	6·1	+1·0	24·1
	Koilpatti*	0·0	0·0	0·0
	Palamkottah	0·6	−0·7	6·7
West Coast	Trivandrum	2·7	−1·4	45·4
	Cochin	10·1	+1·1	106·9
	Calicut	4·0	−3·7	97·3
	Pattambi*	3·4	−5·0	80·3
	Taliparamba*	0·0	0·0	0·0
	Kasargode*	6·0	−3·2	110·0
	Nileshwar*	3·8	−5·6	104·7
	Mangalore	5·4	−5·0	104·5
Mysore and Coorg	Chitaldrug	2·9	−1·6	23·6
	Bangalore	6·6	−0·4	24·9
	Mysore	2·2	−2·0	17·1
	Mercara	7·8	−3·0	87·3
Hills	Kodaikanal	5·5	−1·8	33·4
	Coonoor			
	Ootacamund*	3·9	−1·9	25·3
	Nanjanad*	5·5	+0·4	33·3

*Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 published in the Fort St. George Gazette.

Two weak western disturbances and five depressions in the Bay of Bengal were responsible for the wide activity of the monsoon throughout the month. There were general thunder showers in Malabar, Konkan, South Hyderabad and Madras Deccan; local thunder showers in North Hyderabad, Bombay Deccan, North Madras Coast and Mysore and a few falls in South East Madras. The rainfall was in defect in all places except in the Carnatic and parts of the Southern and Central Districts.

Skies were generally, moderately to heavily clouded throughout the Peninsula and the humidity was in excess in South East Madras, Mysore, Madras Deccan and Malabar.

The maximum temperature in shade was above normal in South East Madras while it was below normal in Mysore, Madras Deccan and North Madras Coast. Nellore recorded the highest maximum of 102°F on the 10th.

Chief amounts of rainfall.

Vellore	..	3·7″	on the 8th.
Cocanada	..	3·5″	on the 9th.

Calingapatam	...	3·2″	on the 13th.
Cuddapah	...	4·4″	on the 17th.
Anantapur	...	4·1″	on the 17th.
Cochin	...	3·0″	on the 25th.
Cuddalore	...	3·3″	on the 27th.

Weather Report for Research Institute Observatory.

Report No. 9/39.

Absolute maximum in shade	...	92·0°F
Absolute minimum in shade	...	66·0°F
Mean maximum in shade ...	...	88·8°F
Departure from normal ...	...	- 0·7°F
Mean minimum in shade ...	...	70·8°F
Departure from normal ...	...	+ 0·3°F
Total rainfall for the month	...	0·9″
Departure from normal ...	...	- 0·9″
Heaviest fall in 24 hours ...	...	0·35″ on 27th.
Number of rainy days ...	...	3
Mean daily wind velocity ...	...	3·5 M. P. H.
Departure from normal ...	...	- 1·8 M. P. H.
Mean humidity at 8 hours ...	...	76%
Departure from normal ...	...	+ 2·5%

Summary. But for the local showers on the 10th, 11th and 27th instants, the month was practically dry. The rainfall was 0·9″ of which 0·35″ was received on the 27th. The rainfall was only half the normal amount. Skies were moderately to heavily clouded and the humidity was above normal. The mean maximum temperature was slightly below normal and the mean minimum temperature was very slightly above normal.

P. V. R. & F. L. D.

Departmental Notifications.

1. Promotions.

The following promotions of Upper Subordinates in the Agricultural and Science Sections are ordered with effect from 15th August 1939.

Agricultural Section :— Sri. S. V. Doraiswami Ayyar from V grade (old) to IV grade (old).

Science Section :— Sri. P. Satyanarayana and Sri. R. Kochukrishna Pillai from V grade (old) to IV grade (old).

2. Transfers.

Name of officers.	From	To
Sri. P. R. Subramania Ayyar,	Asst. A. D., Udayagiri	Tiruttani sub circle.
„ N. Raghava Rao,	Offg. A. D., Nandigama	Science Section as offg. Asst. in Entomology.
„ V. M. Ramunni Kidavu,	F. M., A. R. S., Taliparamba	A. D., Badagara.
Janab Syed Muhammad,	A. D., Tiruppur	A. D., Gudalur to open a new sub circle.
Sri. K. Ramanujacharya,	F. M., A. R. S., Nandyal	A. D., Nandyal.
„ T. Krishna Reddy,	A. D., Nandyal	F. M., A. R. S., Nandyal.
„ K. Krishnan	A. D. (on leave)	Gudalur to open a new sub circle.
„ R. Krishnamurthi,	Cotton Asst., A. R. S., Nandyal (on leave)	A. D., Saidapet.

3. Leave.

Name of officers.	Period of leave.
Sri. C. A. S. Ramalingam Pillai, A. D., Ariyalur.	Extension of l. a. p. on m. c for 5 months and 10 days and half average pay for 10 days from 21—5—39.
„ K. Ramanujacharya, F. M., A. R. S., Nandyal.	L. a. p. on m. c. for 2 months from 15—9—39.
„ M. L. Narayana Reddy, Asst., A. D., Palakonda.	Extension of l. a. p. on m. c. for 2 months from 20—9—39.
„ N. V. Narasimhasastri, Asst., A. D. (on leave).	L. a. p for 3 months and 16 days from 16—8—39.
„ K. S. Krishnamurthy Ayyar, A. D., Trichinopoly.	Extension of l a. p. for 1 month and 7 days from 1—10—39.
„ C. K. Ramachandran, Asst. in Cotton A. R. S., Hagari.	Earned leave for 45 days from 4-10-39.
„ G. Ganapathy Ayyar, Asst. in Chemistry, Coimbatore.	L. a. p. for 1 month from 2—10—39.
„ Margabandu, V., Asst. in Entomology, Coimbatore.	L. a. p. for 1 month from 9—10—39.
„ K. Hanumantha Rao, Asst. in Paddy, A. R. S., Pattambi.	L. a. p. for 1 month and 21 days from 1—10—39.
Janab P. P. Syed Muhammad, A. D., Tiruppur.	L. a. p. for 2 months and 3 days from 26—9—39.
Sri. K. Kuppamuthu, A. D., Cuddalore.	L. a. p. for 2 months from 23—10—39.
Mr. K. Cheriyan Jacob, Asst. in Systematic Botany.	L. a. p. for 1 month and 21 days from 1—11—39.

Agricultural College and Research Institute, Coimbatore.

Additions to the Library during September 1939.

A. Books.

1. *Farm Organization and Management.* Forster, G. W. (1938). 2. *Cotton Growing in Hyderabad State—Vol. I—A Report on a Survey of the Cotton Crop—1931-35.* Sawhney, K. (1939). 3. *Sugarcane Diseases in Hawaii.* Martin, J. P. (1938). 4. *The Tobacco Industry : A Selected List of references on the Economic Aspects of the Industry—1932-1938.* Bercaw, L. O., Comp. (1938). 5. *The Fundamentals of Fruit Production—2nd Edition.* Gardner, V. R., Etc. (1939). 6. *Commercial Fruit and Vegetable Products—2nd Edition.* Cruess, W. V. (1938). 7. *Part-time Farming in the United States : A Selected List of References.* Hennefrund, H. C., Comp. (1939). 8. *Legislative Protection and Relief of Agriculturist Debtors in India.* Sivaswamy, K. G. (1939). 9. *Statistical Technique in Agricultural Research.* Paterson, D. D. (1939). 10. *Physiology of Plants.* Seifriz, W. (1938). 11. *Fundamentals of Biochemistry with Laboratory Experiments.* Schmidt, C. L. A. & Allen, F. W. (1938). 12. *The Chemistry of the Amino Acids and Proteins.* Schmidt, C. L. A. (1938)

B. Annual Reports of the Agricultural Departments, Etc.

1. Baluchistan Agency Administration Report for 1937-38. 2. Canada Dominion Grain Research Laboratory—Annual Report for 1938. 3. Long Ashton (Bristol) Agri-Horticultural Research Station Annual Report, 1938. 4. California Agricultural Experiment Station, Biennial Report—1936-38. 5. Connecticut Agricultural Experiment Station Annual Report for 1937. 6. Florida Agricultural Experiment Station Annual Report for 1937-38.